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CPP funds allocation: restoring financial stability or minimising risks of non-repayment to taxpayers?

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Abstract

The U.S. Federal Reserve responded to liquidity shortage through compulsory loan guarantee scheme and bank recapitalisations mainly under Capital Purchase Program (CPP) for commercial banks. The bailout packages provided under CPP seem to be efficient in responding to the liquidity crisis subject to large banks that contributed the most to systemic risk. However, smaller banks that were actually exposed to the mortgage market and non-performing loans were denied the financial aid or received CPP funds of a relatively smaller size. Such CPP funds allocation was efficient from the point of view of taxpayer as the probability of bailout non-repayments was minimised. However, it did not support real estate loan recapitalisations that could become a reason of large welfare loses for the homeowners.

Keywords: Bailouts, bank recapitalisation, CPP funds, systemic risk

JEL Classification Numbers: E52, E58, G21

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Résumé

La Réserve Fédérale américaine a réagi au manque de liquidité à travers la garantie obligatoire des prêts et des recapitalisations bancaires principalement dans le cadre du Capital Purchase Program (CPP) pour les banques commerciales. Les "bailout packages" fournis sous le CPP semblent efficaces pour répondre à la crise de liquidité en ce qui concerne les grandes banques qui ont contribué le plus au risque systémique. Cependant, les banques de petite taille qui avaient été effectivement exposés au marché hypothécaire et aux prêts non productifs se sont vues refuser l'aide financière ou ont reçu des fonds du CPP en quantité relativement moins importante, ce qui peut expliquer une perte de bien-être par les propriétaires immobiliers. Une telle répartition des fonds du CPP a été efficace du point de vue du contribuable parce que la probabilité de non-remboursement des fonds de sauvetage a été réduite au minimum.

1 Introduction

Financial crisis of 2007 had a large cost for the economy as a whole. Besides the welfare loses for financial institutions, private firms and households, government interventions all over the world have become a heavy burden for the society. Government interventions included various measures that mostly constituted from loans guarantee schemes on newly issued senior unsecured debt and bank recapitalisations. The U.S. Treasury offered a substantial amount of liquidity to banks through purchases of preferred equity stakes under Capital Purchase Program (further referred to as CPP, for more details see Acharya and Sundaram, 2009 ; Panetta *et al.*, 2009 ; King, 2009 ; Cooley and Philippon, 2009 ; Khatiwada, 2009).

The debate concerning the effectiveness of the U.S. rescue packages offered to commercial banks still continues. On one hand, the regulators were concerned about "moral hazard" problem (Dam and Koetter, 2011 ; Gale and Vives, 2002 ; Stiglitz, 2012), on the other hand, bank recapitalisations were unavoidable to support solvent but illiquid banks and to stabilise the financial markets (Fender and Gyntelberg, 2008).

Comparing to other types of government support, purchase of preferred or common shares is often seen as one of the most efficient types of capital infusion (see Wilson and Wu, 2010). Another pro-argument of the CPP is that the program did not end up costing much to taxpayers. It used 204.6 billion dollars of the 250 billion dollars stipulated earlier (more than a third of the total TARP funding) and approximately half of the commercial banks repurchased their preferred shares from the Treasury by the year 2012.

In this article the focus is on the determinants of liquidity provisions under CPP. The goal of the paper is to define, first of all, factors that determined the final bailout allocation (both the fact of receiving CPP funds and the relative size of CPP funds) and the bailout repayments[1]. Based on that, it is possible to assess the effectiveness of CPP according to the goals of the program and the risks for the taxpayers.

The analysis is motivated by several hypotheses. First hypothesis is that the distribution

[1]The bailout repayments under CPP mean repurchase of the Treasury's equity stake

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of CPP funds and its repayment are dependent on financial fragility of the commercial banks just before the crisis. These variables are similar to those used in the probability of default models. The regulators are expected to provide liquidity to more financially fragile banks as well as exposed to so-called "tail risk" that materialized after a secular collapse in housing markets banks.

The second hypothesis is that CPP funds were designed to minimise the spillover effect of the crisis to the economy at large. First, there was a risk of reduction in credit availability due to deterioration of the financial industry's intermediary role. Second, there was a significant counterparty risk, mostly from the side of LCFIs[2].

The contribution of the banks to systemic risk is estimated through Marginal Expected Shortfall (MES) (Acharya *et al.*, 2010), $\Delta CoVaR$ (Adrian and Brunnermeier, 2011), bank size and beta (last two are individual systemic risk indicators).

The third hypothesis is that political contributions (including lobbying activities) and locational advantages of the commercial banks may induce generous distribution of CPP funds towards some banks. Duchin and Sosyura (2012) find the evidence of higher likelihood of politically connected firms to be funded.

The last hypothesis is that excessive risk-taking of the bank have triggered the need of the bank for CPP funds in 2008-2009 (Kibritcioglu A., 2002). The more risk the bank was undertaking prior to crisis of 2007 (proxied by the change in bank's stock returns), the higher should have been its loses during the crisis and, thus, the greater its need in CPP funds is expected to be comparing to other banks.

The article is completing the literature on bailouts and the effectiveness of liquidity provisions. It tends to improve the assessment of bailout programs through additional analysis of bailout repayments during four years following the disbursement of CPP funds. It is potentially an important source of information concerning the realised risks of funding allocation that were tried to be avoided by the Federal Reserve when designing the bailout packages.

[2]Large Complex Financial Institutions

Various econometric models are applied to analyse the capital injections under CPP and their reimbursement : logit, OLS, polytomous and duration models.

Results of logit and OLS regressions suggest that the rescue packages in the U.S. were designed in a way to provide liquidity to more financially distressed and more systemically important commercial banks. From this point of view, the CPP program can be assessed as a successful bailout program that helped to recapitalise large financial institutions with temporal liquidity problems and to avoid the collapse of entire banking system.

According to the results of polytomous and duration models banks that were larger contributors to systemic risk (measured through MES, beta and bank size) were also the ones that repaid their loan totally and in the shorter period of time. Thus, from the point of view of taxpayer the risks of non-repayment and the time until the CPP funds repayment were minimised.

On the other hand, bailout packages failed to support the banks that were actually exposed to mortgage and non-performing loans as well as mortgage-backed securities. Banks with higher share of mortgages in their total loans are found to exhibit a smaller probability of receiving CPP funds and if approved for the program to receive a smaller size loan. The same pattern is found for the commercial banks more exposed to MBSs and non-performing loans.

It could be explained by the fact that regulators classified such banks as insolvent with higher risk of bailout non-repayment. The banks with larger share of mortgage and non-performing loans on their balance sheets are associated with higher probability of CPP funds non-repayment during 2009-2012 and longer duration until repurchase of their stock from the Treasury.

The rest of the paper is structured as follows. Section 2 presents the estimation methodology. Section 3 introduces the data, describes dependent and explanatory variables. Empirical results for cross-section logit, OLS, polytomous and time-to-event regressions analysing the factors that determined CPP funds disbursement and their repayments are presented in

Section 4. Section 5 concludes.

2 Model specifications for studying CPP funds allocation and their repayments

2.1 Determinants of CPP funds allocation in 2008-2009 : logit and OLS regressions

Allocation of CPP funds among commercial banks in the U.S. is analysed using logistic regression and cross-section OLS. The former one focuses on the probability of the CPP funds disbursement to the particular commercial bank, while the latter one studies the relative size of the distributed CPP funds.

Logit regression allows to estimate the probability of the dependent variable to be equal to 1 (probability that some event occurs). Here BD_i represents a binary variable that takes a value of 1 if a particular bank i received CPP funds in 2008-2009 ; 0 otherwise.

Cross-sectional bailout probability $Pr(BD_i)$ is modeled in the next way :

$$Pr(BD_i) = \alpha_0 + \beta BC_{i,2007} + \gamma SR_{i,2007} + \chi PL_{i,2006-2008} + \eta RT_{i,2003-2006} + \epsilon_i$$

where $BC_{i,2007}$ represent bank balance sheet characteristics for 2007 (indicators from private bank and company default models) ; $SR_{i,2007}$ are measures of bank systemic risk (and contribution to systemic risk) in 2007 ; $PL_{i,2007}$ are variables measuring political influence and locational advantages of the bank ; $RT_{i,2003-2006}$ include variables associated with bank excessive individual risk-taking during the four years prior to crisis.

The detailed description of the variables and its selection is provided in section 3 and in appendix.

OLS model includes the same predictive variables while dependent variable is continuous

and represents the relative size of disbursed amounts.

2.2 Determinants of CPP refunds during 2009-2012

2.2.1 Multinomial (polytomous) logistic regression

This type of regression is used in order to define which factors influenced the probability of bailout repayments by the U.S. banks. The discrete dependent variable in that model represents the bank's progress in CPP refund by July 31, 2012. The set of coefficients for explanatory variables is estimated for each outcome : no bailout $y = 0$, bailout and total repayment $y = 1$, bailout and partial repayment $y = 2$, bailout and no repayment $y = 3$ (see details in appendix).

There is no data available separately on applications for the bailouts and approvals for participation in CPP. The banks from the sample which did not receive CPP funds were, on one hand, banks that were refused the funds due to insolvency and high risk of taxpayer-funded credit non-repayment. On the other hand, these were the banks that did not require that kind of aid or could attract alternative external financing. Banks that received the bailout and repaid it totally during 2009-2012 should have been more financially stable than those that did not repay the bailout, otherwise banks potentially abused the bailout program in order to keep additional liquidity in their financial turnover and to generate extra income.

The model requires to set one outcome as a base one, thus, setting coefficients for that outcome equal to zero. That is, when setting outcome "bailout and total repayment" ($y = 1$) as an arbitrary, the coefficients for remaining outcomes measure the change relative to that base group.

2.2.2 Duration analysis

Under the Capital Purchase Program financial institutions have received the funds at more or less the same period (mostly fourth quarter of 2008), while the date of repayment has been defined by each bank individually. The time until the bailout repayment is another

measure describing the realised risks of CPP funds allocation.

A central component of the analysis in this section is the hazard rate which is the probability of the CPP refunds at time t_i, conditional on not having repaid the bailout before (or having survived to time t_i).

The semiparametric Cox proportional hazards model does not make assumptions about the shape of $h_0(t)$. However, when a correct form of the $h_0(t)$ is chosen, the model could fit the data better and could produce better results.

Parametric models can be based, on one hand, on the proportional hazards assumption, on the other hand, on the accelerated failure time assumption.

To capture the monotonically increasing shape of the hazard function (the graph of Kaplan-Meier estimate is available on demand), the Weibull distribution is chosen (see details in appendix).

The flattening of the Kaplan-Meier survival estimate at the end of distribution, however, suggests a possibility of non-monotonic pattern of duration dependence. The log-logistic distribution is chosen among other AFT models.

The choice between the parametric models is made using the Akaike Information Criterion (AIC) and log-likelihood. The AIC scores are compared between the parametric models. The lowest value of AIC is found for the Weibull model of baseline hazard, even though the graph of hazard function estimates (available on demand) suggests a greater resemblance with log-logistic and log-normal models. Log-logistic distribution of hazard function is preferred to log-normal one according to AIC criterion, besides it is commonly used when fitting data with censoring.

Thus, three duration models are finally fitted : the Cox proportional hazards model (no specific parametrization), the Weibull proportional hazards model (monotonically increasing hazard function) and the log-logistic model (non-monotonic unimodal hazard).

3 Data and summary statistics

3.1 Data description

To construct the sample of firms, U.S. domestically controlled commercial banks were selected in DataStream. These financial firms operated on the U.S. market in U.S. dollars and were still active on December, 2008. After selecting variables needed for estimation, around 650 commercial banks were left in the sample.

The data on bailouts (promised amount, actually disbursed amount, the date of entering the program) and bailout reimbursement (amount repaid, date of repayment) is obtained from Treasury's Office of Financial Stability. The data on political contributions and lobbying expenditures of PACs [3] related to banks comes from the website of the Federal Election Commission in the U.S.

The data from three sources is merged (see details in appendix). Bailouts under CPP were provided to domestically controlled banks, bank holding companies, savings associations, and savings and loans holding companies. 707 financial institutions finally received financing under CPP. Commercial banks that appear on the bailout list received the bailout, while others did not. Only actually disbursed amount is considered as a fact of the bank bailout.

After outliers selection procedure, 597 banks are left in the sample.

3.2 Dependent variables

3.2.1 CPP funds allocations in 2008-2009

- *Bailout dummy*

  The variable BD_i is a dummy that takes on two values, 0 and 1 (see table 1) to distinguish between the banks that did not receive CPP funds and those who did. Banks that have finally received CPP funds applied for Capital Purchase Program

[3] Political Active Committees

(CPP), have been approved for funding and then accepted the funds. Out of 597 banks in the sample approximately 320 banks did not receive a bailout, while around 280 received the CPP funds.

- INSERT TABLE 1 -

- *Bailout continuous variable*

Bailout continuous variable represents actually disbursed CPP funds amount normalised by bank total assets. The maximum relative size of the bailout reaches 7% (see table 1). Among the bailed out banks more than 50% obtained capital of the relative size between 2% and 3% of their total assets. The correlation with dependent variables is shown in table 2. Correlation coefficients are higher in its absolute values for the bailout dummy but the most correlated explanatory variables remain the same for the relative size of bailout.

- INSERT TABLE 2 HERE -

3.2.2 CPP refunds between 2009 and 2012

- *Bailout repayments*

This discrete dependent variable classifies the banks in four groups : banks that did not receive the bailout at all ($y = 0$), banks that received the bailout and repaid it totally ($y = 1$), repaid it partly ($y = 2$) or did not repay the bailout at all ($y = 3$).

Slightly more than half of represented banks did not receive the CPP funds during 2008-2009. Around 20% of the banks received the bailout and repaid it totally, another 20% of the banks never repaid it by 31 of July, 2012, while small fraction of the banks (less than 5%) repaid it partly (majority of these banks repaid at least 50% of the total amount).

- *Time-to-repayment*

The time at risk or time until the event occurs (here the CPP funds repayment) is analysed in duration models.

Only bailed out banks are considered for the analysis. Thus, around half of observations are left in the sample, around 280 banks. The analysed period is limited between the distribution of the CPP funds in 2008 and July 31, 2012. In this period approximately half of these banks repaid the bailouts while others did not.

CPP refund is only taken into account if the bank managed to repurchase the total amount of preferred shares from the Treasury by the end of the analysed period (total refund). Time to repayment is counted in days.

The data and the repayment announcements suggest the first repayments to take place in March of 2009, around half a year after the start of CPP program. For the rest the probability of CPP refunds increases with time (see 2.2.2 for details).

3.3 Bank balance sheet characteristics

Bank balance sheet characteristics are financial statement variables that define the "financial health" of the bank, or, in other words, determine the probability of the bank's default (Duchin and Sosyura, 2012 ; Ratnovski and Huang, 2009). Here indicators from the next three models are included : Altman's Z-score, KMV Moody's RiskCalc for U.S. banks, BondScore (Credit Sights) model. Some indicators appear to be highly correlated with each other and need to be excluded from the final estimation.

3.3.1 Altman's Z-score

Z-score bankruptcy model proposes Z-score indicator for each firm as a discriminant score that represents level of distress of that firm. Five financial ratios constitute the score with defined weights for each of them (see details in appendix). Higher Z-score is interpreted as an indicator of a "safer" or, in other words, more financially healthy firm, while low Z-score

indicates higher level of distress of the firm.

It is expected that safer financial firms before the crisis should experience less need in bailout funds during the crisis and, thus, probability of the bailout for such banks should be lower.

3.3.2 Moody's KMV RiskCalc V3.1 U.S. Banks

More recent Moody's KMV RiskCalc V3.1 is the Moody's rating agency model for predicting probability of the bank default. It comprises financial statement variables and equity market information on the bank's prospects and business risk.

As expected default frequency measures as well as the formula for computing them are not available in public access, the input variables of Moody's model are plugged directly in the regressions (taking into account multicollinearity issues with indicators from other models). Each category is represented by at least one variable, descriptive statistics is provided in table 1. Some variables are discussed below.

Asset Concentration group consists of two variables : **relative size of real estate mortgage loans** (AC_1 in tables) and **commercial and industrial loans** (AC_2 in tables) in the bank's portfolio.

Real Estate Mortgage Loans (AC_1) include commercial and construction mortgages, thus, its relative size could be positively correlated with the size of commercial and industrial loans (AC_2). It appears though that two normalised sizes of these groups of loans are highly but negatively correlated with each other (correlation coefficient is -0.89, table 2). It means that if bank loan portfolio is concentrated in real estate mortgage loans, the bank loans less for commercial and industrial purposes[4]. That gives an impression of a bank "specialisation".

Liquidity-related variables (**Liquidity group**) should measure the share of liquid assets on the balance sheet of the bank. Moody's RiskCalc v3.1 U.S. Banks model (2006) and Basel II regulation classified mortgage-backed securities (MBS) as safe and liquid holdings. That

[4]Commercial and industrial loans represent a general amount of loans made to business and industry excluding commercial mortgages and including consumer loans

was indeed the case at the time, MBSs also included government mortgages provided by Government National Mortgage Association or other U.S. agencies.

In the recent crisis MBSs became highly risky and illiquid assets. That is why the initial indicator proposed in Moody's RiskCalc model that brings together Treasury securities and mortgage-backed securities (as both representing liquid groups of assets) is replaced by two separate ratios.

Asset Quality group is represented by the **share of non-performing loans in total loans**. Lower asset quality is expected to increase the probability of default and, consequently, the probability of the bailout. Nevertheless, the correlation coefficient between bailout dependent variables and normalised non-performing loans in 2007 is negative (-0.11 and -0.12 with bailout dummy and relative size of disbursed amount, table 2).

3.3.3 BondScore Model

BondScore Credit Model is another model that calculates credit risks for all U.S. non-financial corporations with total assets in excess of $250 millions and publicly traded equity.

Three variable from BondScore Model are analysed (others are similar or even same as variables from Moody's RiskCalc Model) : ratio of EBITDA to bank's net sales (EBITDA margin, EM), leverage (Lev) and volatility of EBITDA (Vol). It is expected that commercial banks with higher margin, smaller leverage and smaller volatility exhibit a smaller probability of default and, consequently, less shortage in liquidity during the crisis.

However, first two BondScore variables cannot be kept in regressions due to the high risk of multicollinearity.

3.4 Systemic Risk variables

The bailout packages were designed in large part to limit systemic risk in the financial system - that is, risk of a spillover effect of a crisis from one big institution to another and from the financial sector to the economy at large.

One of the most frequently used proxies of systemic risk is a firm's size (standardised, $Size$, table 3). It supports "too big to fail" argument : the lender of last resort cannot deny support to large financial institutions whose closure would significantly affect the rest of the market (Freixas and Parigi, 2008). Correlation coefficients are presented in table 4. Bank's size is indeed highly and positively correlated with bailout dependent variables.

- INSERT TABLE 3 HERE -

The second variable that represents the systemic risk is $Beta$. It is the correlation between stock returns of financial institution and the overall market. In the period of crisis market in general performed very badly, thus, firms with higher beta should exhibit a higher probability of default and thus, require government intervention.

- INSERT TABLE 4 HERE -

$\Delta CoVaR$ was developed by Adrian and Brunnermeier (2009). $\Delta CoVaR$ represents the difference between the Value-at-Risk of financial sector conditional on the institution "i" being under distress and Value-at-Risk in regular times (see details in appendix).

Marginal Expected Shortfall (MES_α) is expected percentage loss in market value faced by one institution given that a shock drives the market beyond the threshold C (market drop by more than a certain threshold, see details in appendix).

MES is calculated over three different periods (it could not be done with $\Delta CoVaR$ as there are not enough observations) : for the year 2007, for the period of 8 years preceding the crisis (from 2000 to 2007) and for the periods of Bear Stearns and Lehman Brothers collapses (February and March of 2008 ; September and October of 2008).

All the measures of systemic risk are calculated in a way that the higher value of the variable indicates higher contribution of the commercial bank to the systemic risk. Correlation coefficients from table 4 are positive confirming that higher contribution to systemic risk is associated with the higher probability of the bailout and larger relative size of the disbursed amount.

3.5 Political Involvement and Location related variables

The financial sector is one of the largest contributors to federal political campaigns. Political contributions are not done directly by the financial firms but through especially organised political action committees (PACs). The data on PACs contributions only contains information on official contribution of the bank-related PACs so only 3.3% of the financial firms are found to be contributors between 2006 and 2008.

Lobbying expenditures is another form of political support of government agencies. The political involvement dummy is then constructed which takes on value of 1 if in the underlined period the PAC related to the particular bank made a political campaign or lobbying contribution, 0 otherwise. Correlation of political involvement dummy with dependent variables suggests positive influence of the former on the latter one (0.12, 0.08 and 0.08 with bailout dummy, relative size of disbursed amount and repayment categorical variable).

The distribution of bank assets across the states is not the same. Even when the size of bank assets in two states is similar, the distribution of bank assets across organisation size is never identical (Berger *et al.*, 1995) in these two states. Thus, the state dummy is then included into regression.

3.6 Excessive bank's risk-taking related variables

Several attempts to use the past history of financial institution were made in the literature to see if banks with riskier strategies learned in past crises or continued following original business concepts[5].

The representative variable from this group aims to account for individual risk-taking of the bank.

Change in stock prices is calculated as a difference of log stock prices between 2003 and 2006. Firms that take on more risk and follow riskier strategies with higher returns are

[5]For instance, through the performance of the banks during LTCM crisis in 1998, Fahlenbrach *et al* (2011)

expected to experience an important increase in their stock prices in that period (due to the development of securitization and other financial instruments). These should also be the firms that are hit the most during the crisis and that require government intervention to remain active on the market.

It is logical that several financial ratios proposed by different probability of default models are similar to each other. Including all of them could be a reason of high multicollinearity in the regressions that would lead to greater standard errors and larger estimated coefficients. The correlation matrix for all financial indicators is shown in table 2.

4 Results

4.1 Results for Logit and OLS regressions analysing the bank bailout probability and the relative size of disbursed amount under CPP during 2008-2009 in the U.S.

The results are reported in table 5. Columns 3, 5 and 7 present results for logit regressions with binary outcome : bailout or no bailout. Columns 4, 6 and 8 present results for OLS cross-sectional regressions where the dependent variable is the actually disbursed amount normalised by bank's total assets. For each model, the results for three alternative regressions are reported with different measures of systemic risk : beta ($Beta_{i,2007}$), columns 3 and 4 ; bank size ($Size_{i,2007}$), columns 5 and 6 and Marginal Expected Shortfall over 7 years from 2000 to 2007 ($MES_{i,2000-2007}$), columns 7 and 8.

In order to avoid large tables and concentrate on significant variables, regressions are conducted using stepwise backward selection method with significance level for removal of 0.05. Balance sheet variables, systemic risk and individual excessive risk-taking variables are standardized. It makes the size of parameters (or effects of the explanatory variables) comparable within each column.

The empirical evidence is in favor of the main argument provided in the beginning of this article : the bailouts have been provided to the more financially distressed firms (illiquid commercial banks). Banks with higher Z-score in 2007 (thus, "safer" or more financially stable banks according to Altman's Z-score) exhibit a smaller probability of bailout in 2008-2009 (see columns 3, 5 and 7, table 5) and if bailed out, they receive CPP funds of a smaller size (see columns 4, 6 and 8, table 5).

- INSERT TABLE 5 HERE -

Besides, OLS regression with beta (column 4, table 5) suggests that an increase in Z-score by one (variable is standardised, thus its standard deviation is equal to one) is associated with reduction in the relative bailout size by 0.3%.

Among Moody's RiskCalc model indicators these are asset concentration, liquidity and asset quality variables that are significant and that remain robust in each regression.

The empirical results suggest that the banks more specialised in commercial and industrial loans (AC_2 in tables) than in mortgage lending (AC_1 in tables) were more likely to be bailed out (and to receive larger amounts of financial aid) in 2008-2009.

On one hand, the crisis of 2007 was originated in the subprime loan market and one could expect regulators to start saving banks with higher share of mortgage loans. On the other hand, under both Basel I and Basel II the weight of mortgage loans in risk-weighted assets was smaller than that of corporate loans. Thus, banks exposed to corporate loans could be considered as more affected during the crisis.

In many cases banks that have originated large amounts of mortgage loans securitised them, repacked and then sold to third-party investors in form of mortgage-backed securities. These assets (including AAA-rated mortgage-backed tranches) became illiquid following the collapse in housing markets. The one could expect monetary regulators to focus on saving the banks with higher exposure to mortgage-backed securities in order to raise the liquidity in financial market. Results show that it was not the case : firms with higher exposure to mortgage-backed securities (Liq_2 in tables) were less likely to be bailed out (and if bailed

out, received a smaller amount).

Treasury securities remained one of the most liquid and, thus, high demanded financial assets during the financial crisis. Hence, more liquid banks in terms of higher share of treasury securities (Liq_1 in tables) on their balance sheets should have been financially more stable during the crisis and should not have applied for the financial funds (or applied for a relatively smaller amount). The estimated coefficients from table 5 confirm that argument.

Part of originated before the financial crisis loans remained on the banks' balance sheets. It could be argued that banks preferred to leave on their balance sheets high quality loans while subprime loans have been mostly securitised and sold to other entities (Acharya *et al.*, 2010). That problem is otherwise referred to as an "adverse selection" problem of lenders.

However, subprime and lower quality loans have had much higher yield than any other type of loans and could be left on the banks' balance sheets (as well ABCP, CDOs and CLOs). Furthermore, due to the abrupt rise in the interest rates even prime borrowers experienced difficulties with repayment of their debt. Results suggest that banks with higher share of non-performing loans in 2007 (AQ in tables), however, had a smaller probability to receive CPP funds and if received, their size was smaller.

Systemic risk variables beta ($Beta_{i,2007}$), bank size ($Size_{i,2007}$) and MES ($MES_{i,2000-2007}$) have positive significant coefficients which means that regulators concentrated in offering liquidity to larger, more correlated with the market and riskier institutions. Another measure of systemic risk, $CoVaR_{i,2000-2007}$ is not significant which can be due to not long enough period of estimation and low frequency of used data (no other data is available in free access).

Political involvement variable appears positively significant only in one regression which also can be due to the poor data available in the free access.

State dummy is not significant at all, as well as bank's individual risk-taking measured by the past performance of the bank's stock prices.

Models fit the data well, R-squared (pseudo R-squared for logit) reaches 17%-18%.

4.2 Polytomous and time-to-repayment regressions analysing the bank repayments of CPP funds during 2009-2012 in the U.S.

4.2.1 Polytomous logistic model

This multinomial model is used to define the factors that determine the probability of bailout repayment/non-repayment under the CPP during 2009-2012. Dependent variable describes if the bank was bailed out or not, and if it was, which share of the bailout did the bank repay : total amount, a part of the disbursed amount or nothing at all (see section 3.2.2 for details).

Results for multinomial regressions are presented in terms of signs of the estimated coefficients in table 6. The full results with exact values of the coefficients are available on demand. The base outcome is a positive decision concerning the bank bailout under CPP and its total repayment by commercial bank during 2009-2012.

- INSERT TABLE 6 HERE -

The third column of table 6 reports results for the group of banks that did not receive CPP funds ("No bailout"). The signs of the multinomial estimates show the change (positive or negative) in logit of outcome "no bailout" (group "0") relative to the group of banks that received CPP funds and repaid them totally (group "1") given the other variables in the model are held constant.

These results confirm those for logit and OLS regressions from the previous section. Safer banks or more financially stable banks (with higher Altman's Z-score in 2007) are less likely to receive CPP funds during the crisis. Positive sign in table 6 indicates that increase in bank's Altman's score (Z) in 2007 is associated with higher probability of a bank not to be bailed out by the government in 2008-2009.

Commercial banks with higher shares of real estate mortgage loans (AC_1) and non-performing loans (AQ) are more likely to receive no CPP funds as it is suggested by the signs of coefficients from the third column "No bailout". Besides, even if banks with higher

share of that sort of loans received the bailout, they exhibit a higher probability not to repay it (table 6, column 5 "Bailout and no repayment"). An opposite effect is found for the banks that are more exposed to commercial and industrial loans (AC_2) : they are more likely to be bailed out and less likely not to repay it during 2009-2012.

These results should be thought of in two ways, from the point of view of minimising the risks for taxpayers and from the point of view of restoring the financial stability. From the point of view of taxpayer, the risks have been minimised. The CPP funds were provided to the banks with the highest probability of repaying them in short term : banks with smaller exposure to mortgage and non-performing loans and higher exposure to commercial loans.

However, from the point of view of consumers and borrowers, the program had a potentially ineffective side. Commercial banks with higher exposure to mortgage loans and non-performing loans did not get enough external financing from the government in the period of the crisis. Banks more specialised in real estate mortgage loans were the ones affected the most by the crisis and without appropriate help from the government potentially failed to restructure a large part of mortgage loans and continued to perform poorly due to a large amount of foreclosures. Facing liquidity problems such banks needed to raise mortgage interest rates putting even creditworthiness homeowners in difficult financial position.

Banks with stronger positions in treasury securities (Liq_1) and MBSs (Liq_2) before the crisis are less likely to be bailed out in 2008-2009. The first relationship is justified by high safety and liquidity of Treasury bills, especially in the time of crisis ("flight to security" argument). The second relationship is less clear as MBSs became highly illiquid during the crisis. There are two potential explanations : first, banks kept on their balance sheets MBSs of a good quality[6] ("adverse selection" argument), second, government help was provided to the banks that have had higher chances to repay it, thus, to those banks that were less exposed to MBSs.

If the results for "No bailout" outcome (column 3) are compared with the results for

[6]Agency-backed MBSs of the prime loan type.

"Bailout and no repayment" (column 5) outcome, it can be noticed that liquidity indicators described above as well as Z-score are not significant in predicting the repayment/non-repayment of CPP funds by the commercial banks. It means that, first of all, that more financially stable and liquid firms prior to crisis applied less for CPP funds (and potentially were rarely approved for participation in the program). Secondly, if they applied, their level of safety and liquidity before the crisis did not affect the probability of the CPP funds repayment. Besides, higher exposure to MBSs is not associated with later or earlier CPP funds repayment.

All systemic risk variables are significant with negative coefficients when predicting the "No bailout" (column 3) and "Bailout and no repayment" (column 5) outcomes. The signs of the estimates tell us that larger banks with higher potential contribution to systemic risk (higher beta $Bets_{i,2007}$ and MES $MES_{i,2000-2007}$) were less likely not to receive CPP funds. That confirms that CPP was designed to bail out systemically important and "too big to fail" financial institutions.

Besides, a large part of banks with higher contribution to systemic risk repaid the bailout totally during 2008-2009 (or had a lower probability of CPP funds non-repayment). It allows to conclude that the focus of CPP on bailing out systematically important institutions was effective from both sides. From the point of view of taxpayer these banks were the ones that repurchased their shares in the shortest notice. From the point of view of borrowers and restoring of financial stability the failure of large institutions was avoided which could have led to the large externality costs for the other sectors of economy.

Thus, more systematically important, large and interconnceted financial institutions could be finally characterised as "temporarily illiquid but healthy" during the crisis. Nevertheless, it shoud not be forgotten that larger banks have greater capacities of restoring their activities that are represented in diverse forms and of attracting alternative sources of financing partly due to their "too big to fail" position.

It is at some point logical that these institutions could repurchase their shares form

the Treasury fast enough and it does not confirm the soundness of "too big to fail". The big collapse of these institutions was avoided, however, more reforms should be introduced (expanding the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010, see Acharya *et al.*, 2011 for the discussion) in order to limit the propensity of the financial sector to put the entire system at risk and to benefit from its too-big-to-fail position.

It can be concluded then that in terms of efficiency for taxpayers the CPP funds have been disbursed in the correct way, in order to limit the probability of CPP funds non-repayments. Besides, the collapse of large financial institutions has been avoided that could have been translated into the collapse the entire banking sector. However, banks which could if properly motivated help to avoid the bankruptcy of the large number of homeowners and other borrowers have not been supported.

4.2.2 Time to repayment analysis

This section presents the results for duration analysis where dependent variable is the time until CPP funds repayment. The choice of parametrizations for that analysis is described in section 2.2.2. Each continuous variable that enters the model is checked for correlation with the dependent variable. Besides, the models with single continuous predictors are considered as well as the results of the Chi-squared tests in order to choose predictors for the final model.

Results for three types of regressions (with Cox PH, Weibull and log-logistic parametrizations) are presented in table 7. Besides, the signs of estimated coefficients for log-logistic AFT are also included in table 6 to compare with previous results.

The interpretation of coefficients is different for proportional hazards models (Cox PH and Weibull PH, columns 3, 4, 5 and 6, table 7) and accelerated failure time models (log-logistic AFT, columns 7 and 8, same table). The coefficients from the first pair of models indicate how coviariates affect the hazard rate. Positive coefficients increase the hazard rate and, therefore, reduce the expected duration. The positive coefficients from AFT models indicate

how covariates affect the logged survival time and, hence, increase expected duration.

The first view on the signs of the regression coefficients confirms that results of all three models are coherent. The impacts of covariates are similar in terms of the signs of coefficients, and their level of significance does not change from one model to another.

The results are in line with those presented in the previous sections (columns 5 and 6, table 6). More systemically risky banks managed to repurchase their preferred shares faster than the rest, while those with higher cash flows per share, higher concentration of non-performing and mortgage loans had more difficulties with repaying the bailouts. It can be also the case that banks with higher cash flow per share did not wish to repurchase their shares from the Treasury too fast (as this predictor also has a positive impact on the probability of partial repayment, column 4, table 6) as it was a comfortable and relatively cheap source of external financing comparing to the market conditions.

The goodness of fit is checked by using, first of all, plots of estimated hazard functions and, secondly, Cox-Snell residuals. The plot of the Nelson-Aalen cumulative hazard function for Cox-Snell residuals for the log-logistic function has the poorest fit with respect to the 45° line with the slope of 1. The plots for the models with Weibull and log-logistic parametrizations seem to be the both close to linearity (graphs are available on demand).

5 Conclusion

In the aftermath of the crisis one of the questions that is still discussed by the policy-makers and academics is the effectiveness of the government and Central Bank responses to the financial crisis.

Various econometric techniques are used in this article to study the factors that determined the CPP funds disbursement and their repayment in the period between 2009 and July, 2012. The results from each section are coherent and complement each other.

Bailout packages provided under CPP seem to be efficient in responding to liquidity

crisis subject to the large banks that contributed the most to systemic risk. Due to that, the propagation of the financial crisis was slowed down even though there is many criticism concerning the late response (announcement of loan guarantees and recapitalisations) of the Federal Reserve.

However, it is logical that these institutions could repurchase their shares from the Treasury fast enough and it does not confirm the soundness of "too big to fail". The big collapse of these institutions was avoided, however, more reforms have to be introduced (expanding the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010) in order to limit the propensity of the financial sector to put the entire system at risk and to benefit from its too-big-to-fail position.

The allocation of CPP funds was also effective from the point view of taxpayer. Larger firms with smaller shares of mortgage and non-performing loans, higher shares of commercial loans and greater contributions to systemic risk were the ones with the highest probability to receive the CPP funds and to receive larger amounts but also to reimburse them totally in shorter notice.

Thus, larger and more systemically important banks were mostly considered viable and were recapitalised, while other banks that were actually exposed to the mortgage market were denied financial aid (some of them went bankrupt). In this sense, CPP potentially did not succeed in supporting cosumers' loan recapitalisations and restructurings that could become a reason of large welfare loses for the homeowners.

Designing the programs addressing the housing crisis through minimisation of mortgage default losses could incite faster recovery of financial markets and economy as a whole. Supporting mortgage-specialised banks could reduce the number of delinquent borrowers, foreclosures and other externalities.

Appendices

A Construction of variables

A.1 Altman's Z-score

Altman's Bankruptcy model suggests an index based on the five main financial ratios where weight of each variables defined using discriminant analysis :

$$Z = 0.012X_1 + 0.014X_2 + 0.033X_3 + 0.006X_4 + 0.999X_5$$

where X_1 is the ratio of difference between current assets and current liabilities to total assets ; X_2 is the ratio of retained earnings to total assets ; X_3 is the ratio of earnings before interest and taxes (EBIT) to total assets ; X_4 is the ratio of market value of equity to total liabilities ; X_5 is the ratio of sales to total assets.

A.2 Systemic Risk related indicators

Bank size ($Size_{i,2007}$) is calculated as the logarithm of total assets of the bank.

Beta ($Beta_{i,2007}$) is taken from Datastream and represents the measure of the asset's risk with relation to the market (correlation with the market) over the past 5 years. Thus, beta for 2007 is actually calculated for the period from 2002 to 2007.

$\Delta CoVaR_p$ is a systemic risk indicator that measures the marginal contribution of a separate financial firm to the risk of the whole financial sector. As the name of the variable shows it, the prefix "co" stands for conditional, contagion and comovement (Adrian and Brunnermeier, 2011). This measure of *CO*ntribution of the institution i to the systemic risk of the financial system is measured as the difference between Value-at-Risk of the financial sector conditional on institution i being in distress ($VaR_p^{FS|"i"distress}$) and the Value-at-Risk of the financial sector in normal times (VaR_p^{FS}) :

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$$\Delta CoVaR_p^i = VaR_p^{FS|"i"distress} - VaR_p^{FS}$$

Institution *"i"* is said to be in distress when it exhibits the lowest growth rates of its market-valued total financial assets defined through the p^th percentile (here 5^th percentile, thus, bottom 5% of the returns). VaR_p^{FS} is the mean of growth rates of the financial sector in the 5th percentile of its distribution unconditionally on the state of separate institutions. The growth rate of market valued total assets (X_t^i) is calculated in the next way :

$$X_t^i = \frac{ME_t^i \cdot LEV_t^i - ME_{t-1}^i \cdot LEV_{t-1}^i}{ME_{t-1}^i \cdot LEV_{t-1}^i} = \frac{A_t^i - A_{t-1}^i}{A_{t-1}^i}$$

Knowing that

$$A_t^i = ME_t^i \cdot LEV_t^i = BA_t^i \cdot (\frac{ME_t^i}{BE_t^i})$$

where ME_t^i is the market value of an intermediary i's total equity, LEV_t^i is the ratio of total assets to book equity, A_t^i are market-valued total assets, BA_t^i are book-valued total assets, $\frac{ME_t^i}{BE_t^i}$ is market-to-book ratio of the institution *"i"*.

Following Adrian and Brunnermeier (2011) the growth rate of the whole financial sector is calculated as the average market-valued returns of all financial institutions, weighted by the lagged market value of their assets :

$$X_t^{FS} = \sum_i (X_t^i \cdot w_{t-1}^i)$$

where w_{t-1}^i is the weight of the financial institution i in the financial sector at the period *t-1*. The (unconditional) Value-at-Risk of the financial sector is then defined as the bottom 5% of the growth rate of the financial sector between 1990 and July, 2008 (quarterly data from Compustat). The Value-at-Risk of the financial system conditional on institution i being in distress is calculated as the mean of growth rates of financial sector in the periods when institution i was found to be in distress. The difference between the two measures is

$\Delta CoVaR_p^i$, the contribution of the institution i to the risks of financial sector in general.

Marginal Expected Shortfall (MES_α) is expected percentage loss in market value faced by one institution given that a shock drives the market beyond the threshold C (market drop by more than a certain threshold). Expected shortfall is the average of financial market returns on days when the portfolio's loss exceeds its VaR limit. The financial market return R is the sum of each bank's return r_i :

$$R = \sum_i w_i \cdot r_i$$

where w_i is the weight of bank "i" in the overall banking system. The expected shortfall of the financial market can be then represented as a weighted sum of individual banks' expected shortfall :

$$ES_\alpha = -\sum_i w_i E[r_i \,|R \leq -VaR_\alpha]$$

The derivative of the financial system expected shortfall with respect to the weight of bank y_i is then bank "i"'s expected shortfall :

$$\frac{\partial ES_\alpha}{\partial w_i} = -E[r_i \,\big|R \leq -VaR_\alpha] = MES_\alpha^i$$

Here MES_α^i is calculated with $100\% - \alpha = 95\%$ confidence. Thus, $MES_{5\%}^i$ is computed in the next way :

$$MES_{5\%}^i = \frac{1}{N} \sum_{t:R-in-its-5\%-tail} r_t^i \tag{1}$$

where $\frac{1}{N} \sum_{t:R-in-its-5\%-tail} r_t^i$ is the average of returns of financial firm i in the 5% worst-case periods of aggregate stock market losses (measured on a daily basis through S&P 500 index). $MES_{5\%}^i$ is calculated for the year 2007, 2006 and over 8 years between 2000 and 2007.

TABLE 1: Summary of dependent variables and balance sheet characteristics from Altman's and Moody's models for U.S. commercial banks

Variable	Name	Obs	Mean	Std. Dev.	Min	Max
Bailout dummy	BD_i	644	0.44	0.5	0	1
Size of the bailout normalised by bank total assets	B_i	644	0.01	0.01	0	0.07
Bailout and repayment categorical variable	R_i	644	0.87	1.16	0	3
Z-score, standardized	Z	597	0	1.00	-2.92	4.27
Moody's RiskCalc U.S. Banks						
Total equity to total assets, winsorized at 2% level, standardized	CS_1	661	0	1	-1.20	3.54
Total deposits to total assets, winsorized at 1% level, standardized	CS_2	642	0	1	-1.67	2.80
Net revenues to total assets, winsorized at 1% level, standardized	P_1	654	0	1	-2.25	3.68
Cash flow per share, winsorized at 2% level, standardized	P_2	640	0	1	-0.84	3.50
Mortgage Real Estate Loans to total loans ratio (in percentage), standardized	AC_1	661	0	1	-3.56	2.02
Consumer and Industrial Loans to total loans ratio (in percentage), winsorized at 2% level, standardized	AC_2	653	0	1	-1.22	3.21
Treasury Securities to total assets ratio (in percentage), winsorized at 2% level, standardized	Liq_1	607	0	1	-0.56	3.59
Mortgage-Backed Securities to total assets ratio (in percentage), winsorized at 2% level, standardized	Liq_2	641	0	1	-1.04	3.36
Non-performing loans to total loans ratio (in percentage), winsorized at 2% level, standardized	AQ	661	0	1	-.91	3.69

TABLE 2: Correlation between dependent variables (dummy and relative size of bailout) and explanatory balance sheet variables for US banks

Model	Var	BD	B	R	Z	CS_1	CS_2	P_1	P_2	AC_1	AC_2	Liq_1	Liq_2	AQ	EM	Lev	Vol
Bail-t dummy	BD	1.00															
Bail-t size	B	0.90	1.00														
Repay-t	R	0.82	0.78	1.00													
Altman's Z-score	Z	-0.20	-0.16	-0.22	1.00												
Moody's	CS_1	-0.15	-0.12	-0.15	**0.66**	1.00											
RiskCalc	CS_2	0.11	0.07	0.06	-0.06	-0.19	1.00										
	P_1	-0.05	0.00	-0.03	0.24	-0.07	-0.08	1.00									
	P_2	0.04	0.01	0.04	0.11	-0.02	-0.03	0.15	1.00								
	AC_1	-0.16	-0.15	-0.05	0.01	0.06	0.10	-0.19	-0.08	1.00							
	AC_2	0.15	0.16	0.06	-0.04	-0.06	-0.12	0.20	0.08	**-0.89**	1.00						
	Liq_1	-0.17	-0.19	-0.14	0.00	0.07	-0.08	-0.15	-0.02	-0.01	-0.03	1.00					
	Liq_2	-0.10	-0.11	-0.15	0.03	0.00	0.26	-0.31	-0.05	-0.01	-0.02	-0.02	1.00				
	AQ	-0.11	-0.12	0.03	-0.24	-0.08	0.04	0.15	0.13	0.07	-0.03	0.03	-0.11	1.00			
Bond	EM	0.05	0.02	-0.05	**0.56**	0.12	0.29	0.02	-0.02	0.03	-0.05	-0.03	0.11	-0.43	1.00		
	Lev	0.15	0.14	0.20	**-0.77**	-0.44	0.14	-0.22	-0.11	0.07	-0.08	0.02	-0.03	0.19	-0.37	1.00	
	Vol	0.02	0.04	0.07	-0.15	-0.12	0.12	0.22	-0.02	0.10	-0.01	-0.11	-0.06	0.18	-0.14	0.02	1.00

TABLE 3: Summary of BondScore balance sheet characteristics, systemic risk, political involvement and individual risk-taking related variables

Variable	Name	Obs	Mean	Std. Dev.	Min	Max
BondScore U.S.						
$\frac{EBITDA_{2007}}{Sales_{2007}}$, winsorized at 2%level, standardized	EM	632	0	1	-3.24	1.83
$\frac{Debt_{2007}}{MarketCap+BookValueDebt_{2007}}$, winsorized at 1%level, standardized	Lev	604	0	1	-3.57	2.52
$Volatility_{2007}$, standardized	Vol	502	0	1	-1.88	3.43
Systemic risk						
Size (logarithm of total assets), standardized	$Size_{i,2007}$	661	0	1	-2.84	3.49
Beta, standardized	$Beta_{i,2007}$	621	0	1	-1.76	2.78
Marginal expected shortfall (MES) for 2007, standardized	$MES_{i,2007}$	626	0	1	-2.41	2.95
Marginal expected shortfall (MES) over 8 years between 2000 and 2007, winsorized at 1%level, standardized	$MES_{i,2000-2007}$	632	0	1	-1.87	3.65
Marginal expected shortfall (MES) for the Bear Stearns and Lehman Brothers near-collapse, winsorized at 1%level, standardized	$MES_{i,BSLB}$	608	0	1	-1.81	2.51
Conditional Value-at-Risk, standardized	$\Delta CoVaR_{i,1990-2007}$	628	0	1	-3.13	1.97
Political influence and location						
Political influence dummy	$PD_{2006-2008}$	658	0.03	0.18	0	1
State	$State$	661	25.90	14.39	1	51
Individual risk-taking						
Change in log stock prices during 2003-2006, winsorized at 1% level, standardized	$\ln(q_{i,2003-2006})$	525	0	1	-3.09	2.64

TABLE 4: Correlation between dependent variables (dummy and relative size of bailout) and explanatory systemic risk, political influence, location and individual risk variables for US banks

Type	Var	BD	B	R	$Size$	$Beta$	$MES_{i,2007}$	$MES_{i,2000-2007}$	$MES_{i,BSLB}$	$\Delta CoVaR$	PD	$State$	$ln(q_{i,2003-2006})$
Depend var-s	BD	1.00											
	B	0.90	1.00										
	R	0.82	0.77	1.00									
Systemic	$Size$	0.24	0.14	0.18	1.00								
Risk	$Beta$	0.26	0.26	0.19	**0.62**	1.00							
	$MES_{i,2007}$	0.12	0.06	-0.02	**0.74**	**0.62**	1.00						
	$MES_{i,2000-2007}$	0.16	0.10	0.00	**0.78**	**0.61**	0.80	1.00					
	$MES_{i,BSLB}$	0.15	0.09	0.00	**0.68**	**0.59**	0.90	0.74	1.00				
	$\Delta CoVaR$	0.05	0.02	0.00	0.25	0.14	0.19	0.20	0.17	1.00			
	PD	0.12	0.08	0.08	0.39	0.20	0.19	0.24	0.18	0.15	1.00		
	$State$	-0.04	-0.04	-0.03	-0.01	-0.06	0.02	0.02	0.02	0.01	0.01	1.00	
	$ln(q_{i,2003-2006})$	-0.04	-0.02	-0.04	-0.12	-0.09	-0.09	-0.09	-0.08	-0.11	-0.02	-0.03	1.00

TABLE 5: Determinants of the bank bailout probability and the relative size of the bank bailout under the Troubled Asset Relief Program in 2008-2009, U.S. commercial banks, stepwise cross-sectional estimation

Type of var	Name	**Logit** With *Beta*	**OLS** With *Beta*	**Logit** With *Size*	**OLS** With *Size*	**Logit** With *MES*	**OLS** With *MES*
Balance sheet char-s							
ALTMAN'S	Z	-0.712***	-0.003***	-0.910***	-0.003***	-0.691***	-0.003***
Z-SCORE		(-4.288)	(-5.119)	(-5.441)	(-5.543)	(-4.24)	(-6.07)
MOODY'S	CS_2					0.285*	
RISKCALC						(2.38)	
	P_1	-0.331**				-0.267*	
		(-2.304)				(-1.97)	
	AC_1	-0.372***	-0.002***			-0.422***	-0.002***
		(-3.111)	(-2.957)			(-3.58)	(-3.27)
	AC_2			0.230**	0.002***		
				(2.143)	(2.663)		
	Liq_1	-0.437***	-0.002***	-0.377***	-0.002***	-0.424***	-0.002***
		(-3.385)	(-3.186)	(-3.051)	(-3.425)	(-3.43)	(-3.65)
	Liq_2	-0.509***	-0.002***	-0.498***	-0.002***	-0.581***	-0.002***
		(-3.616)	(-4.211)	(-3.698)	(-4.151)	(-4.04)	(-3.97)
	AQ	-0.345***	-0.002***	-0.378***	-0.002***	-0.292**	-0.0015**
		(-2.934)	(-3.719)	(-3.316)	(-3.402)	(-2.58)	(-2.97)
Systemic Risk var-s							
	$Beta_{i,2007}$	0.613***	0.003***				
		(5.019)	(6.158)				
	$Size_{i,2007}$			0.749***	0.003***		
				(5.826)	(5.094)		
	$MES_{i,2000-2007}$					0.330**	0.00153**
						(2.69)	(2.71)
Political inv-t							
	$PD_{2006-2008}$	1.895**					
		(2.214)					
	Constant	-0.213*	0.011***	-0.318***	0.011***	-0.188	0.0109***
		(-1.836)	(20.38)	(-2.78)	(19.93)	(-1.69)	(20.01)
	R^2		0.178		0.148		0.128
	Pseudo-R^2	0.166		0.150		0.126	
	Obs	508	507	517	517	522	521

TABLE 6: The influence of the main factors determining the CPP funds disbursement and repayment, U.S. commercial banks, from polytomous logistic regression and survival analysis. Base outcome for polytomous regression : bailout and total repayment

		Polytomous	regression		Survival analysis
Variable	Name	No bailout	Bailout and partial repayment	Bailout and no repayment	Time to repayment (AFT)
Balance sheet charac-s					
Altman's Z-score	Z	+			−
Cash flow per share	P_2		+		+
Mortgage loans normalised by total loans	AC_1	+		+	+
Commercial and industrial loans normalised by total loans	AC_2	−		−	−
Treasury securuties normalised by total assets	Liq_1	+			
MBS normalised by total assets	Liq_1	+			
Non-performing loans normalised by total loans	AQ	+	+	+	+
Systemic risk variables					
Beta	$Beta_{i,2007}$	−		−	−
Size	$Size_{i,2007}$	−		−	−
MES	$MES_{i,2000-2007}$	−		−	−
	Pseudo R^2	0.156	0.168	0.153	
	Obs	505	514	519	279

TABLE 7: Time to the CPP funds repayment analysis, U.S. commercial banks, proportional hazards (PH) and accelerated failure time (AFT) models

Type of var	Name	**Cox PH** With *Beta*	**Cox PH** With *MES*	**Weibull PH** With *Beta*	**Weibull PH** With *MES*	**Log-logistic AFT** With *Beta*	**Log-logistic AFT** With *MES*
Balance sheet char-s							
ALTMAN'S	Z	0.199**	0.128	0.212***	0.143*	-0.143**	-0.103
Z-SCORE		(2.562)	(1.569)	(2.693)	(1.775)	(-2.294)	(-1.610)
MOODY'S	P_2	-0.108**	-0.113***	-0.107**	-0.114***	0.073**	0.085***
RISKCALC		(-2.468)	(-2.625)	(-2.468)	(-2.653)	(2.260)	(2.708)
	AC_1	-0.315***	-0.301***	-0.303***	-0.289***	0.206***	0.177***
		(-3.488)	(-3.209)	(-3.415)	(-3.171)	(2.862)	(2.659)
	AQ	-0.366***	-0.418***	-0.381***	-0.434***	0.250***	0.264***
		(-2.919)	(-3.131)	(-2.986)	(-3.196)	(2.910)	(3.062)
Systemic Risk var-s	$Beta_{i,2007}$	0.221**		0.213**		-0.134**	
		(2.364)		(2.275)		(-2.018)	
	$MES_{i,2000-2007}$		0.395***		0.392***		-0.291***
			(4.639)		(4.611)		(-4.384)
	Constant			-11.796***	-12.108***	7.040***	7.010***
				(-12.849)	(-12.979)	(74.831)	(73.900)
	$Ln(p)$			0.483***	0.510***		
				(5.976)	(6.372)		
	$Ln(gamma)$					-0.654***	-0.701***
						(-7.690)	(-8.339)
	AIC	1406.630	1406.519	546.147	536.265	549.771	537.188
	Obs	275	279	275	279	275	279

Références

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